

CLAIM SET FOR NATIONAL PHASE ENTRY FOR PCT/US2003/023155 AND
 PCT/US2003/023057

1. An isolated polynucleotide comprising a nucleic acid sequence, wherein the nucleic acid sequence has greater than 90% identity to a nucleotide sequence selected from the group consisting of SEQ ID NO:1, 3, 5, and 7, wherein the nucleotide sequence encodes a fucosyltransferase that catalyzes the transfer of a fucose residue from a donor substrate to an acceptor substrate.
2. The polynucleotide of claim 1, wherein the nucleic acid sequence is selected from the group consisting of SEQ ID NO:1, 3, 5 and 7.
3. The polynucleotide of claim 1, wherein the fucosyltransferase catalyzes the transfer of fucose to an N-acetylglucosamine residue, and wherein the nucleic acid sequence has greater than 90% identity to a nucleotide sequence selected from the group consisting of SEQ ID NO:1, 3, and 7.
4. The polynucleotide of claim 1, wherein the fucosyltransferase catalyzes the transfer of fucose to a glucose residue, and wherein the nucleotide acid sequence has greater than 90% identity to SEQ ID NO:5.
5. An isolated polynucleotide comprising a nucleic acid sequence, wherein the nucleic acid sequence encodes a fucosyltransferase that catalyzes the transfer of a fucose residue from a donor substrate to an acceptor substrate, and wherein the fucosyltransferase comprises an amino acid selected from the group consisting of SEQ ID NO:2, 4, 6, and 8.
6. The polynucleotide of claim 5, wherein the fucosyltransferase comprises an amino acid tag.
7. An expression vector comprising the isolated polynucleotide of claim 1 or claim 5.
8. A host cell comprising the expression vector of claim 7.
9. A method of producing a fucosyltransferase protein, the method comprising the step of culturing the host cell of claim 8 under conditions suitable for expression of the fucosyltransferase protein.
10. An isolated polynucleotide comprising a nucleic acid sequence, wherein the nucleic acid sequence consists of SEQ ID NO:11, wherein the nucleotide sequence encodes a biologically

active fucosyltransferase that catalyzes the transfer of a fucose residue from a donor substrate to an acceptor substrate.

11. The polynucleotide of claim 10, wherein the fucosyltransferase catalyzes the transfer of fucose to a glucose residue.
12. An isolated polynucleotide comprising a nucleic acid sequence, wherein the nucleic acid sequence encodes a biologically active fucosyltransferase, and wherein the fucosyltransferase comprises an amino acid that consists of SEQ ID NO:12.
13. An expression vector comprising the isolated polynucleotide of claim 10 or claim 12.
14. A host cell comprising the expression vector of claim 13.
15. A method of producing a fucosyltransferase protein, the method comprising the step of culturing the host cell of claim 14 under conditions suitable for expression of the fucosyltransferase protein.
16. A recombinant fucosyltransferase protein comprising a polypeptide has greater than 90% identity to an amino acid sequence selected from the group consisting of SEQ ID NO:2, 4, 6, and 8, wherein the fucosyltransferase catalyzes the transfer of a fucose residue from a donor substrate to an acceptor substrate.
17. The recombinant fucosyltransferase of claim 16, further comprising an amino acid tag.
18. The recombinant fucosyltransferase of claim 16, wherein the polypeptide is selected from the group consisting of SEQ ID NO: 2, 4, 6, and 8.
19. The recombinant fucosyltransferase of claim 16, wherein the fucosyltransferase catalyzes the transfer of fucose to an N-acetylglucosamine residue, and wherein the polypeptide has greater than 90% identity to an amino acid sequence selected from the group consisting of SEQ ID NO:2, 4, and 8.
20. The recombinant fucosyltransferase of claim 16, wherein the fucosyltransferase catalyzes the transfer of fucose to a glucose residue, and wherein the polypeptide has greater than 90% identity SEQ ID NO:6.
21. A recombinant fucosyltransferase protein comprising a polypeptide consists of SEQ ID NO:12, wherein the fucosyltransferase catalyzes the transfer of a fucose residue from a donor substrate to an acceptor substrate.
22. The recombinant fucosyltransferase of claim 21, wherein the fucosyltransferase catalyzes the transfer of fucose to glucose.

23. A method of making a fucosylated oligosaccharide, the method comprising:
contacting the recombinant fucosyltransferase of claim 16 with a mixture comprising a donor substrate comprising a fucose residue, and an acceptor substrate comprising a sugar or oligosaccharide, under conditions where the fusion protein catalyzes the transfer of a fucose residue from the donor substrate to the acceptor substrate, thereby producing a fucosylated oligosaccharide.
24. The method of claim 23, wherein the method further comprises a step of purifying the fucosylated oligosaccharide.
25. The method of claim 23, wherein a donor substrate is GDP-fucose.
26. The method of claim 23, wherein the fucosyltransferase comprises an amino acid tag.
27. The method of claim 23, wherein an acceptor substrate comprises a member selected from N-acetylglucosamine and glucose.
28. The method of claim 23, wherein the acceptor substrate is Lacto-N-neo-Tetraose (LNnT).
29. The method of claim 28, wherein the fucosylated oligosaccharide is Lacto-N-Fucopentaose III (LNFP III).
30. The method of claim 23, wherein the mixture further comprises lactose, a β -1,3-N-acetylglucosaminyltransferase, and a β -1,4-galactosyltransferase.
31. The method of claim 30, wherein the β -1,3-N-acetylglucosaminyltransferase is a bacterial enzyme.
32. The method of claim 31, wherein the β -1,3-N-acetylglucosaminyltransferase is from *Neisseria gonococcus*.
33. The method of claim 30, wherein the β -1,4-galactosyltransferase is a bacterial enzyme.
34. The method of claim 33, wherein the β -1,4-galactosyltransferase is from *Neisseria gonococcus*.
35. The method of claim 30, wherein the fucosylated oligosaccharide is Lacto-N-Fucopentaose III (LNFP III).
36. A method for producing a fucosylated glycolipid, the method comprising:
contacting the recombinant fucosyltransferase protein of claim 16 with a mixture comprising a donor substrate comprising a fucose residue, and an acceptor substrate on a glycolipid, under conditions where the fucosyltransferase catalyzes the transfer of the fucose residue from a donor substrate to the acceptor substrate on the glycolipid, thereby producing a fucosylated glycolipid.

37. A method for producing a fucosylated glycoprotein, the method comprising:
contacting a recombinant fucosyltransferase protein with a mixture comprising a donor substrate comprising a fucose residue, and an acceptor substrate on a glycoprotein, under conditions where the fucosyltransferase catalyzes the transfer of the fucose residue from a donor substrate to the acceptor substrate on the glycoprotein, thereby producing a fucosylated glycoprotein, wherein the recombinant fucosyltransferase protein comprises a polypeptide having greater than 90% identity to an amino acid sequence selected from the group consisting of SEQ ID NO:2, 4, 6, and 8.
38. The method of claim 37, wherein the polypeptide comprises an amino acid sequence selected from the group consisting of SEQ ID NO: 2, 4, 6, and 8.
39. The method of claim 37, wherein the polypeptide comprises SEQ ID NO: 2.
40. The method of claim 37, wherein the polypeptide further comprises an amino acid tag.
41. The method of claim 37, wherein the method further comprises a step of purifying the fucosylated glycoprotein.
42. The method of claim 37, wherein the acceptor substrate is a glucose residue, and wherein the recombinant fucosyltransferase protein comprises a polypeptide having greater than 90% identity to SEQ ID NO:6.
43. The method of claim 37, wherein the acceptor substrate is an N-acetylglucosamine residue, and wherein the recombinant fucosyltransferase protein comprises a polypeptide having greater than 90% identity to an amino acid sequence selected from the group consisting of SEQ ID NO:2, 4, and 8.
44. The method of claim 37, wherein an acceptor substrate on the glycoprotein comprises Galb1-OR, Galb,3/4GlcNAc-OR, NeuAca2,3Galb1,3/4GlcNAc-Or, wherein R is an amino acid, a saccharide, an oligosaccharide, or an aglycon group having at least one carbon atom.